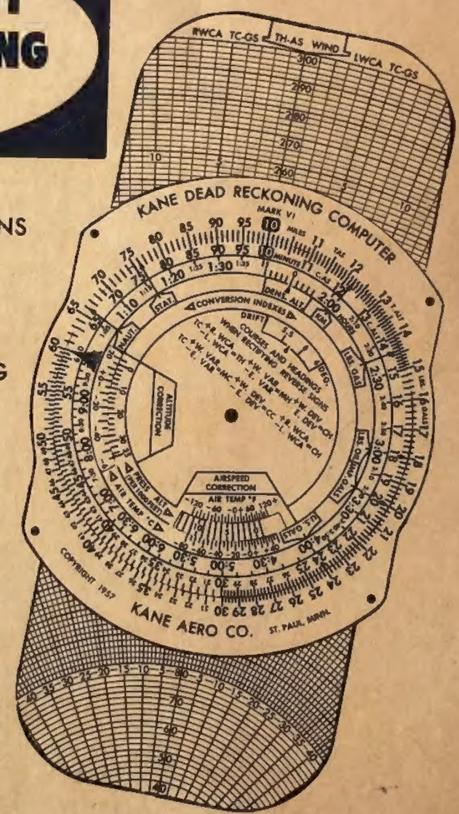
On Course the Kane Way

KANE MARK VI DEAD RECKONING COMPUTER



ILLUSTRATED INSTRUCTIONS
AND
PRACTICE PROBLEMS
FOR
MARK VI AND SKYKING
COMPUTERS

KANE AERO COMPANY
MANUFACTURERS AND PUBLISHERS OF AERONAUTICAL AIDS
1845 FORD PARKWAY
SAINT PAUL 16, MINNESOTA

THE KANE COMPUTER

TYPE MARK VI

AND

"SKYKING"

ILLUSTRATED INSTRUCTIONS AND PRACTICE PROBLEMS

KANE AERO COMPANY
1845 FORD PARKWAY
ST. PAUL, MINN

PRINTED IN USA

PRICE $3.00

SECTION I - THE COMPUTER SLIDE RULE SIDE

DESCRIPTION

The Mark VI is an all metal computer with a metal slide. The graduations are precision engraved on a high grade aluminum alloy. All parts are anodized to provide a hard satin finish surface.

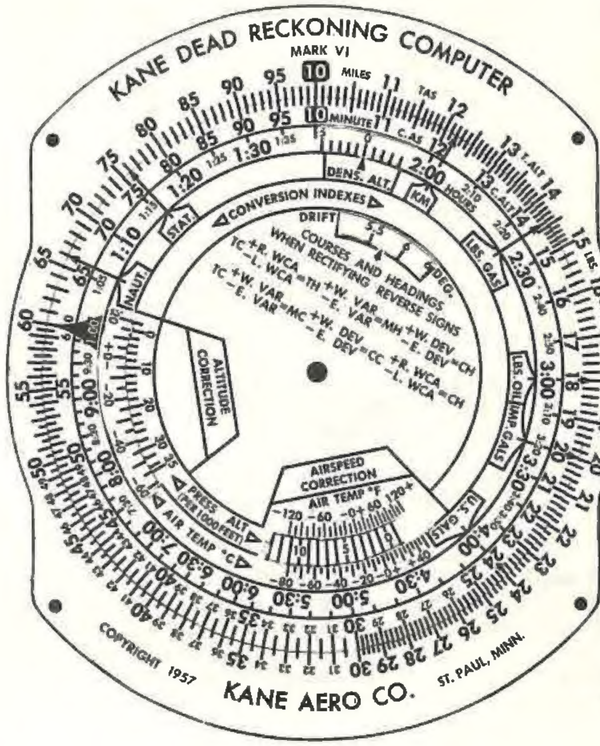


FIG. 1

The circular slide rule side of the computer enables the pilot to solve problems involving time, speed, distance and fuel consumption. Indexes are provided on the inner circular scale for rapid conversion of gallons of fuel or oil to pounds, statute miles to nautical miles and miles to kilometers. Five logarithm sets of scales are used-one main and five auxiliary. The auxiliary scales are positioned on cut-outs or windows. This side of the computer consists of two parts; namely, a stationary body plate known as the miles scale and a rotating disc known as the minute scale.

It is convenient to consider the stationary and rotating scales establish arithmetical proportions. Note that the outer scales in Fig. 2 are positioned to establish a 2 to 1 proportion. Knowing three factors of the proportion, the fourth can be determined.
Example: 90 miles in 45 minutes is 120 miles in 60 minutes (120 MPH.). When using these two scales the decimal point will be positioned as necessary. For example, 12 may be considered 1.2, 12, 120, 1200. A large triangular index has been positioned at the 60 minute graduation and is known as the miles per hour or gallons per hour index.

TIME, GROUND SPEED, DISTANCE PROBLEMS

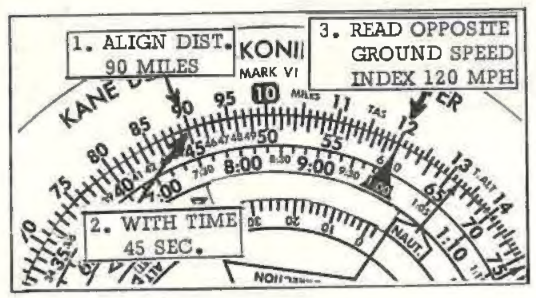


FIG. 2

Solution: See Fig. 2.
Align 90 on the fixed miles scale with 45 on the rotating minute scale. Opposite the ground speed index read 120 on the fixed miles scale.

On all distance, time, ground speed problems, the large triangular index is either set opposite ground speed or will position itself opposite ground speed. Distance and time are always opposite each other.

The rotating disc has two (2) scales. The outer rotating scale is used for minute and the inner rotating scale for hours and minutes. Note that 90 minutes is opposite 1 hour 30 min.

Given:
Distance Flown-90 miles
Time-45 minutes

Find:
Ground Speed 120

CONT. TIME, GROUND SPEED, DISTANCE PROBLEMS

Exercise 1.

No.	Distance (Miles)	Time	Ground Speed (MPH)	No.	Distance (Miles)	Time	Ground Speed (MPH)
1.	90	:45	(120)	6.	65	:30	(130)
2.	80	2:00	(40)	7.	12	:08	(90)
3.	60	:30	(120)	8.	140	1:55	(73)
4.	35	:11	(191) ✓	9.	115	:471/2	(146) X 145 ?
5.	110	:120	(85) X 55	10.	90	1:40	(54)

Given:
Distance–120 miles
Ground Speed–80 mph

Find:
Time 90 m 1:30

Solution: See Fig. 3.
1. Rotate minute scale until Triangular Ground Speed Index is opposite Ground Speed (80 mph) on stationary miles scale.
2. Opposite distance (120 miles) on stationary miles scale read time (90 min.) on rotating minute scale. The hour scale will indicate 1 hour 30 minutes.

Exercise 2.

No.	Distance (Miles)	Time	Ground Speed (MPH)	No.	Distance (Miles)	Time	Ground Speed (MPH)
1.	80	X (:80 m) 1:20	60	6.	110	(:30)	220
2.	120	(:120 m) 2:00	60	7.	170	(:120) m 2:00	85
3.	140	(:120) 2:00	70	8.	115	(:77) m 1:17	90
4.	90	(:40)	135	9.	300	(:156) m 2:36	115
5.	95	(:30)	190	10.	45	(:39½)	78

Given:
Ground Speed–110mph
Time–1 hour, 20 min

Find:
Distance 147

Solution: See Fig. 4.
1. Rotate minute scale until Triangular Ground Speed Index is opposite Ground Spe ed (110 mph) on miles scale.
2. Opposite Minute Scale (1:20) read Distance (147 miles) on stationary miles scale.

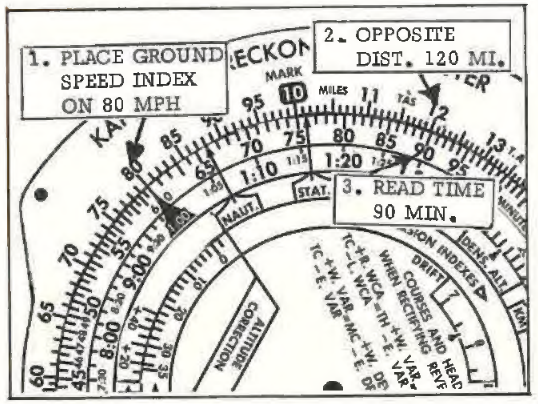


FIG. 3

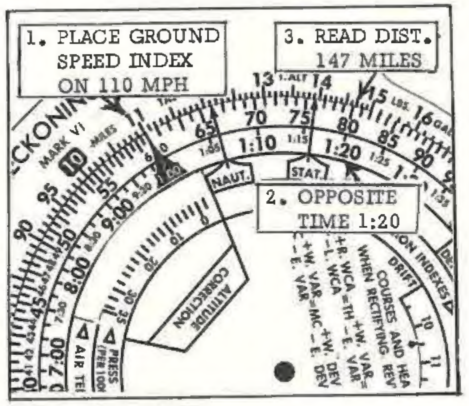


FIG. 4

Exercise 3.

No.	Distance (Miles)	Time	Ground Speed (MPH)	No.	Distance (Miles)	Time	Ground Speed (MPH)
1.	(60)	:90	40	6.	(291)	2:10	134
2.	(45)	:30	90	7.	(320)	1:50	175
3.	(170)	2:00	85	8.	(37)	:25	88
4.	X (230)	2:00 :120	115	9.	(84)	1:25	59
5.	(90)	:37	146	10.	(9)	:07	78

Exercise 4. (Mixed Problems)

No.	Distance (Miles)	Time	Ground Speed (MPH)	No.	Distance (Miles)	Time	Ground Speed (MPH)
1.	140	2:00	? 70	11.	82	? :43	115
2. X	156	:120	? 756 - 78	12.	? 75	:46	98
3.	98	:37	? 159	13.	81	? 45.5	107
4.	75	? :36	125	14.	113	:80	? 85
5.	36	? :16.6	130	15.	8	? :04	120
6.	42	? :17.6	143	16.	? 12.8	:07	110
7.	? 180	3:00	60	17.	120	? 1:40	72
8.	? 82	1:05	76	18.	80	:41 1/2	? 116
9.	? 181	1:37	112	19.	125	? 72 m 1:12	104
10.	166	1:32	? 108	20.	192	? 84 m 1:24	137

FUEL CONSUMPTION PROBLEMS

Fuel consumed (gallons), flying time (hours), and rate of fuel consumed (gallons per hour) are computed in a similar manner to distance, time and ground speed problems. Fuel consumed is comparable to distance and is found on the stationary miles scale. Flying fuel hours used or left is the same as time in flight and is found on the rotating time scale. Rate of fuel consumption (gallons per hour) is found opposite the triangular ground speed index on the stationary miles scale.

Given:
Fuel Available–360 gals.
Time in Flight–8 hours

Find:
Rate of Fuel Consumption

100
58
42

Solution: See Fig. 5.
1. Rotate time scale to position time (8 hrs) opposite fuel available (360 gals) on miles scale.
2. Opposite the triangular rate of fuel consumption index, read rate of fuel consumption (45 gals/hr) on the stationary miles scale.

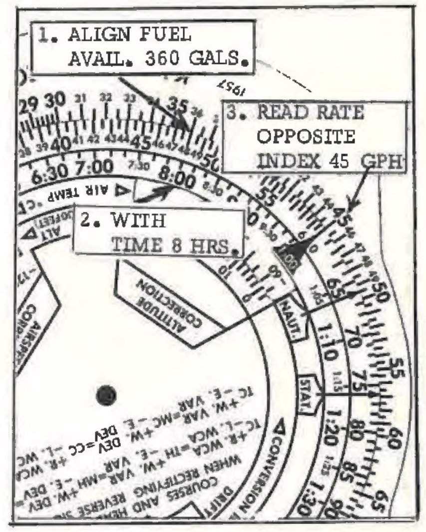


FIG. 5

Exercise 5.

No.	Fuel Available or Consumed (Gallons)	Flying Time Used or Left	Rate of Fuel Consumption (Gals/Hr)
1.	42	4:00	(10.5)
2.	36	3:30	(10.3)
3.	27	2:45	(9.8)
4.	6	:26	(13.8) 13.?
5.	32	3:30	(9.1)

Given:
Fuel Available–250 gals.
Rate of Consumption–41 1/2 gals/hr.

Find:
Fuel Hours Available

Solution: See Fig. 6.
1. Rotate the minute scale so that the triangular rate index (gals. per hr.) is opposite the rate of Consumption (41 1/2 gals. per hr.) on the stationary miles scale.
2. Opposite Fuel Available (250 gals.) on the miles stationary scale read on the Time scale (6 hours).

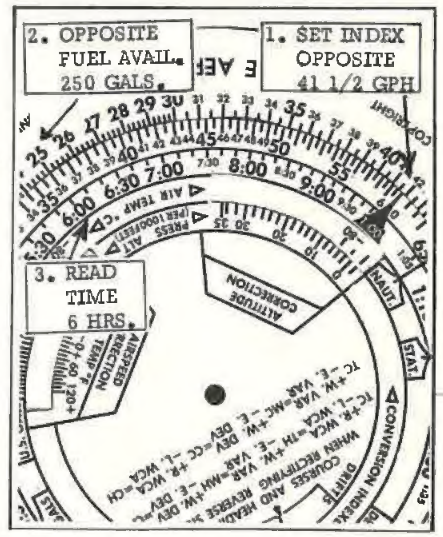


FIG. 6

Exercise 6.

No.	Fuel Available or Consumed (Gallons)	Flying Time Used or Left	Rate of Fuel Consumption (Gals/Hr)
1.	42	(5:15)	8
2.	42	(4:40)	9
3.	37	(5:40)	6 1/2
4.	26	(2:36)	10
5.	40	(2:40)	15

Given:
Rate of Fuel Consumption-9 gals. per hr.
Fuel Time Used-4 hrs.

Find:
Fuel Consumed

Solution: See Fig. 7.
1. Rotate the Time scale so that the triangular rate of fuel consumption Index is opposite 9 on the stationary miles scale.
2. Opposite Fuel Time Used (4 hrs.) on the time scale read Fuel Consumed (36 gals.) on the stationary miles scale.

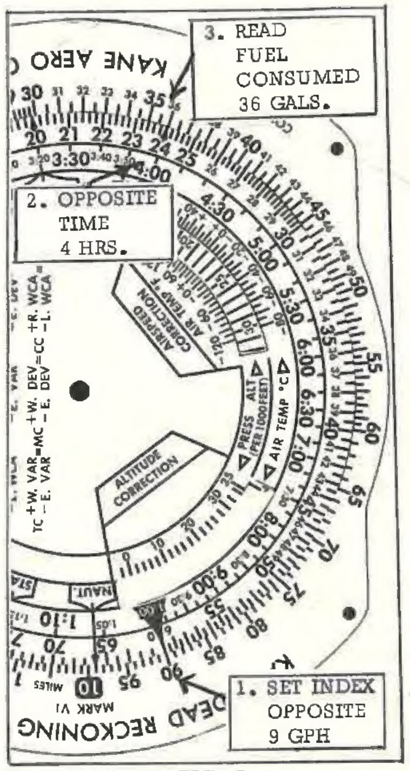


FIG. 7

Exercise 7.

No.	Fuel Available or Consumed (Gallons)	Flying Time Used or Left (Gals/Hr)	Rate of Fuel Consumption (Gals/Hr)
1.	(18)	3:00	6
2.	(21)	2:20	9
3.	(47)	3:45	12 1/2
4.	(13.8)	1:50	7 1/2
5.	(9.9)	1:14	8

MIXED FUEL CONSUMPTION PROBLEMS

Exercise 8.

No.	Fuel Available or Consumed (Gallons)	Flying Time Used or Left	Rate of Fuel Consumption (Gals/Hr)
1.	36	4:00	?
2.	27	3:30	?
3.	16 1/2	?	6
4.	25.3	?	8
5.	?	3:00	7
6.	?	4:15	9
7.	42	?	14
8.	37	2:18	?
9.	22.7	?	8 1/2
10.	?	3:14	10
11.	?	2:50	5.5
12.	25	?	7.9
13.	80	6:10	?
14.	11	:35	?
15.	58	?	15.5
16.	60	4:48	?
17.	?	3:30	6
18.	?	2:15	7.5
19.	23.5	3:12	?
20.	8.5	:53	?

ALTIMETER CORRECTION

The slide rule side of the computer is used for altimeter and airspeed correction computations. When flying from a warm region to a cold, the true altitude is lower than the altimeter indicates. This is a dangerous condition. The pilot should continuously calculate in flight the true altitude from the indicated in accordance with the temperature aloft.

The altimeter is calibrated for the standard atmosphere. It reads correctly only under standard conditions of sea level temperature (15 deg. C. or 59 deg. F.) and normal temperature lapse rate.

For all practical purposes, the pilot may consider PRESSURE ALTITUDE AND CALIBRATED ALTITUDE EQUAL TO INDICATED ALTITUDE. The error in computations will be neglegible. Pressure altitude plus or minus pressure altitude variation is indicated altitude. Calibrated altitude is indicated altitude corrected for installation errors.

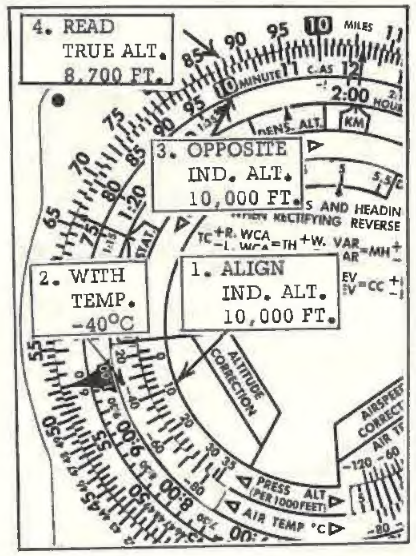


FIG. 8

On the extreme outer scales, note "True Alt." (Corrected altitude) and "Cal.Alt." (Indicated altitude) scales.
It is sufficiently accurate for Pilot-Navigator type of computation to consider that:
1. Pressure altitude equals indicated altitude.
2. Calibrated altitude equals indicated altitude.
3. Corrected altitude equals true altitude.

Given:
Indicated Altitude-10,000 ft.
Temperature Aloft-(-40 deg. C.)

Find:
True Altitude

Solution: See Fig. 8.
1. Align in the altimeter cut-out window Indicated Altitude (10,000 ft. Press. Alt.) with Temperature Aloft (-40 deg. C.).
2. Opposite indicated altitude (10,000 ft.) on the calibrated altitude scale read True Altitude (8700 ft.) on corrected altitude scale.
Caution: Do not use the airspeed window for altimeter correction.

Exercise 9.

No.	Indicated Altitude (Feet)	Temp. Aloft (Deg. C.)	True Alt. (Feet)
1.	20,000	-20	( )
2.	10,000	-10	( )
3.	30,000	-30	( )
4.	10,000	+10	( )
5.	6,000	+15	( )
6.	14,000	+5	( )
7.	5,000	-10	( )
8.	18,000	-5	( )
9.	8,000	+10	( )
10.	12,000	-15	( )

Given:
True Altitude-11,000 ft.
Indicated Altitude-10,000 ft.

Find:
Temperature at Altitude
See Fig. 9.

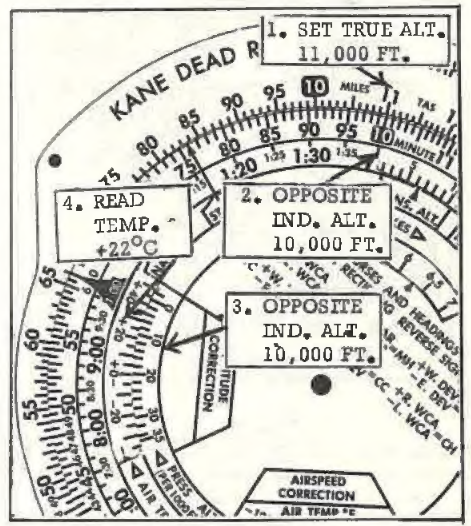


FIG. 9

Solution: See Fig. 9.
1. Opposite True Altitude (11,000 ft.) on corrected altitude scale, place Indicated Altitude (10,000 ft.) on the calibrated altitude scale.
2. Opposite Indicated Altitude (10,000 ft.) on pressure altitude scale, read Air Temperature +22 deg. C.

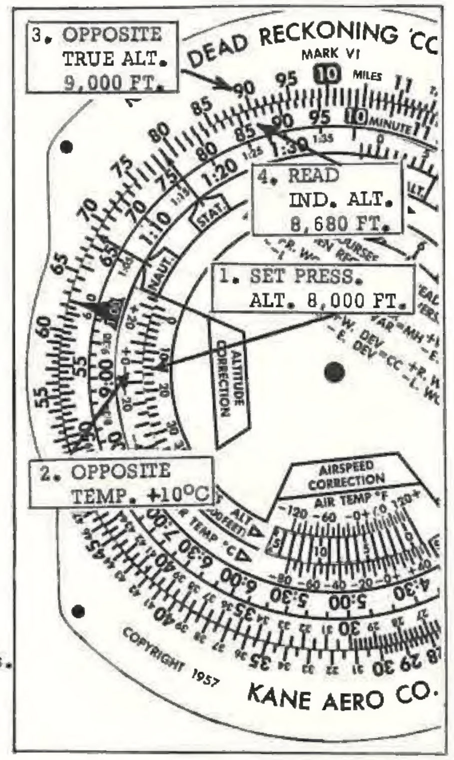


FIG. 10

Exercise 10.

No.	Ind. Alt.	Temp. Aloft	True Alt.
1.	20,000	( )	19,000
2.	25,000	( )	26,000
3.	18,000	( )	18,500
4.	10,000	( )	9,600
5.	11,500	( )	12,000
6.	8,000	( )	8,700

Given:
Pressure Altitude-8,000 ft.
Temperature Aloft-(+10 deg. C.)
True Altitude-9,000 ft.

Find:
Indicated Altitude

Solution: See. Fig. 10.
1. Opposite Pressure Altitude (8,000 ft.) on press. alt. scale, place Temperature (+10) in the altimeter window.
2. Opposite True Altitude (9,000 ft.) on the corrected altitude scale, read Indicated Altitude (8,680 ft.) on the calibrated altitude scale.

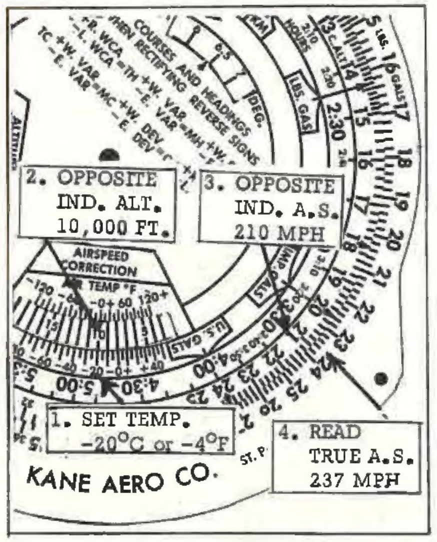


FIG. 11

Exercise 11.

No.	True Alt.	Temp.	Press. Alt.	Ind. Alt.
1.	20,000	-10	21,000	( )
2.	10,000	+ 20	8,800	( )
3.	9,000	+ 5	8,000	( )
4.	15,500	-15	16,000	( )
5.	4,900	-5	5,000	( )
6.	5,500	-20	6,000	( )

AIRSPEED CORRECTION PROBLEMS

The airspeed indicator like the altimeter will read correctly only in the standard atmosphere. Variation in temperature and pressure from standard at a given altitude will result in error. True Airspeed is calibrated airspeed corrected for temperature and pressure. For the pilot navigator, it is sufficiently accurate to use indicated altitude for pressure altitude in the airspeed window.

Again align the index "10" on the miles scale with the index "10" on the minute scale. Note that the true airspeed is on the outer stationary miles scale and calibrated airspeed (indicated airspeed) is on the minute scale; that temperature and pressure aloft are on the airspeed window scales.

The Kane Mark VI computer permits the solution of airspeed correction problems directly using either Centigrade or Fahrenheit terms. No conversion from Fahrenheit to Centigrade is

necessary. Note further that at standard conditions (sea level alt. and 15 deg. C. or 59 deg. F.) true airspeed is equal to indicated. No error exists under this condition.

Given:
Indicated Airspeed-210 mph.
Indicated Altitude-10,000 ft.
Temperature Aloft-(-20 deg. C. or -4 deg. F.)

Find:
True Airspeed

Solution: See Fig. 11.
1. Using "For Airspeed Computation Window" align Temperature Aloft (-20 deg. C. or -4 deg. F.) with Indicated Altitude (10,000 ft. Press. Alt.).
2. Opposite Indicated Airspeed (210 mph.) on the calibrated airspeed scale, read True Airspeed (237 mph.) on the stationary true airspeed scale (miles scale).

Exercise 12.

No.	Ind. A.S.	Indicated Altitude	Temp. Aloft	True A. S.	No.	Ind. A.S.	Indicated Altitude	Temp. Aloft	True A.S.
1.	180	10,000	-10	( )	6.	140	4,000	-5	( )
2.	200	20,000	-30	( )	7.	140	4,000	-30	( )
3.	150	5,000	-15	( )	8.	210	7,000	-15	( )
4.	160	12,000	-10	( )	9.	165	15,000	-20	( )
5.	140	3,000	+5	( )	10.	175	12,000	+5	( )

Given:
True Airspeed-200 mph.
Indicated Altitude-10,000 ft.
Temperature Aloft-(-20 deg. C. or -4 deg. F.)

Find:
Indicated Airspeed

Solution: See Fig. 12.
1. Using "For Airspeed Computation" window, align Temperature Aloft (-20 deg. C. or -4 deg. F.) with Indicated Altitude (10,000 ft.).
2. Opposite True Airspeed (200 mph.) on outer stationary true A. S. Scale, read Indicated Airspeed (177 mph.) on calibrated airspeed scale.

Exercise 13.

No.	Ind. A.S.	Indicated Altitude	Temp. Aloft	True A.S.	No.	Ind. A.S.	Indicated Altitude	Temp. Aloft	True A.S.
1.	( )	12,000	-5	150	4.	( )	6,000	-20	125
2.	( )	20,000	+5	210	5.	( )	5,000	+15	135
3.	( )	18,000	+10	165	6.	( )	7,000	+8	112

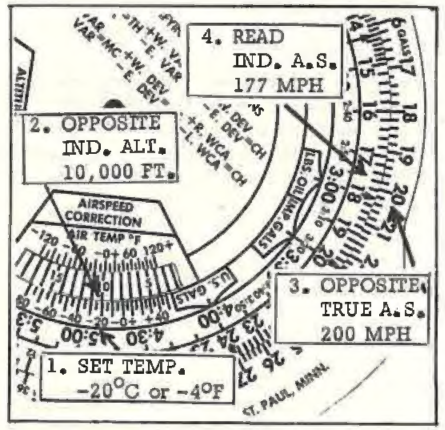


FIG. 12

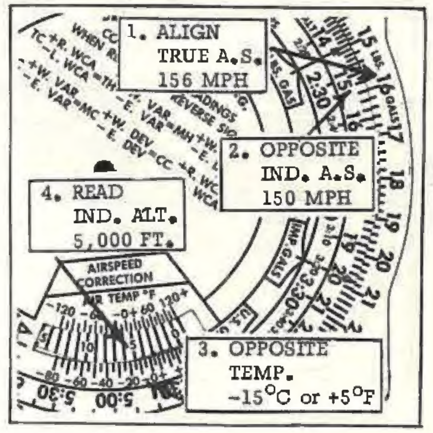


FIG. 13

Given:
True Airspeed-156 mph.
Indicated Airspeed-150 mph.
Temperature Aloft-(-15 deg. C. or +5 deg. F.)

Find:
Altitude to Fly
See Fig. 13

Solution:
1. Align True Airspeed (156 mph.) on the outer stationary true airspeed scale with Indicated Airspeed (150 mph.) on the calibrated airspeed scale.
2. Using "For Airspeed Computation" window, opposite Temperature (-15 deg. C. or +5 deg. F.) read Indicated Altitude (5,000 ft.) on the pressure altitude scale.

Exercise 14.

No.	Ind. A.S.	Indicated Altitude	Temp. Aloft	True A.S.	No.	Ind. A.S.	Indicated Altitude	Temp. Aloft	True A.S.
1.	175	( )	-10	200	4.	145	( )	+ 15	150
2.	230	( )	-35	225	5.	118	( )	+ 5	125
3.	160	( )	-5	185	6.	113	( )	+ 10	125

MIXED AIRSPEED CORRECTION PROBLEMS

Exercise 15.

No.	Ind. A.S.	Indicated Altitude	Temp. Aloft	True A.S.	No.	Ind. A.S.	Indicated Altitude	Temp. Aloft	True A.S.
1.	150	5,000	?	156	6.	128	7,000	?	152
2.	178	12,000	-20	?	7.	158	12,000	-10	?
3.	235	?	-35	270	8.	?	18,300	-18	165
4.	?	16,000	-45	245	9.	165	18,500	?	210
5.	116	?	-5	125	10.	175	?	-45	165

DENSITY ALTITUDE

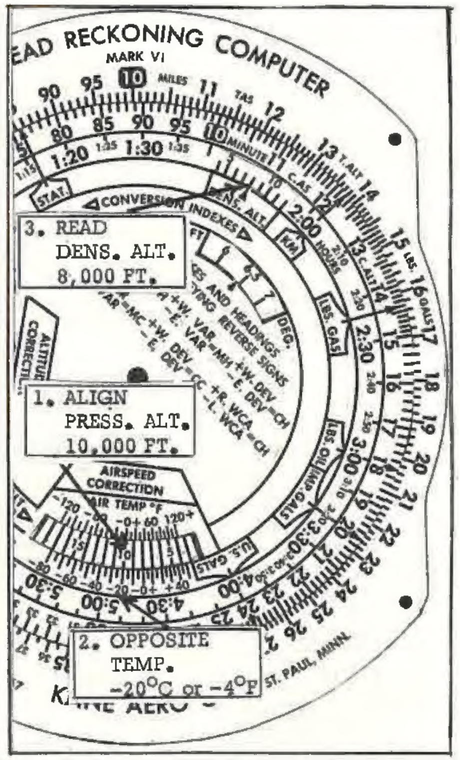


FIG. 14

Density Altitude is pressure altitude corrected for true air temperature at the flight level. Engine power output, fuel consumption and wing lift or rate of climb is dependent on the density altitude. The temperature and pressure altitude of the airspeed auxiliary scales are used to determine density altitude.

Given:
Temperature-(-20 deg. C. or -4 deg. F.)
Pressure Altitude-10,000 ft.

Find:
Density Altitude

Solution: See Fig. 14.
1. On the airspeed auxiliary scales set pressure altitude (10,000 ft.) opposite Temperature (-20 deg. C. or -4 deg. F.). Read on the density altitude scale 8,000 ft.

DRIFT CORRECTION FOR OFF COURSE PROBLEMS

The drift correction angle is the correction which is applied to true course to find the true heading. The amount of drift correction applied should be enough to either parallel the intend track or bring the aircraft back to the intended track at some point. If the aircraft drifted to the left of the intended track it was caused by a stronger than anticipated left wind accordingly, a right wind correction angle must be applied to the true course.
NOTE: The formulae on the center of the computer.

The Kane Mark VI computer is especially designed to solve the above type problems simply by the use of an auxiliary scale. This scale is based on the trignometric sine function of the off course distance to the distance traveled.

It will be helpful to remember that a drift of one mile off course in sixty miles flown results, in a drift of approximately one degree (.95 deg.). If the drift is ten miles in sixty the drift angle is approximately ten degrees (9.5 deg.); in one hundred twenty miles, five degrees (4 3/4 deg.).

Given:
Off Course-12 miles
Distance Flown-136 miles
Distance remaining-68 miles

Find:
Correction angle to parallel course
Correction angle to converge on destination
Total correction angle to converge on destination

Solution:
1. SEE FIG. 15. Align 12 on the stationary miles scale with 136 on the minute scale then read in the auxiliary scale 5 deg. to parallel course.
2. SEE FIG. 16. Align 12 on the outer stationary scale with 68 on the minute scale then read on the auxiliary scale 10 deg.
3. To converge on course add 5 deg. and 10 deg. (15 deg.).

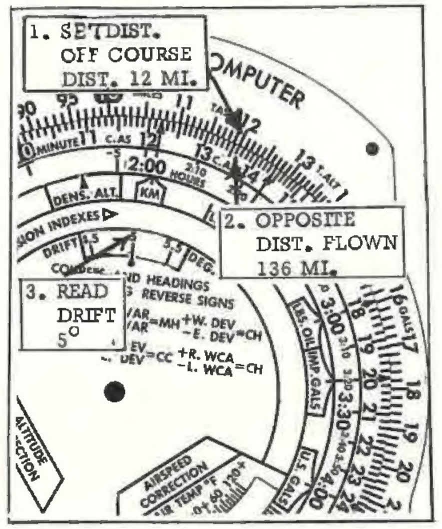


FIG. 15

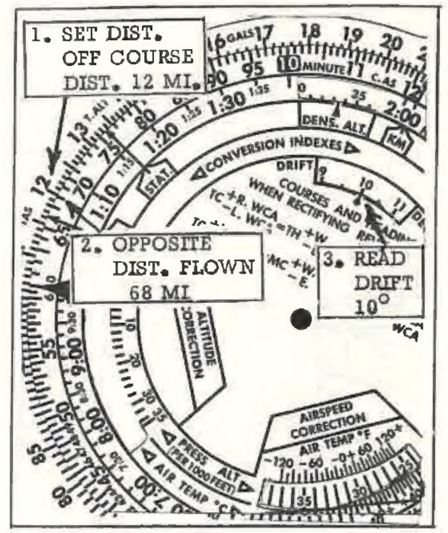


FIG. 16

OFF COURSE PROBLEMS

Exercise 16.

No.	Miles off Course	Miles Out	Miles Left	Angle to Parallel	Angle to Converge	Total Correction Angle
1.	8 R	100	150	( )	( )	( )
2.	10 R	125	175	( )	( )	( )
3.	12 L	60	100	( )	( )	( )
4.	15 L	75	50	( )	( )	( )
5.	6 R	96	66	( )	( )	( )

The drift scale is also useful in determining the off course distance traveled to avoid danger areas or storm areas when the aircraft heading has been changed.

Given:
Ground Speed made good-150 mph.
Time Flown-35 minutes
Heading Altered-18 deg.

Find:
Off Course Distance

Solution:
1. Place ground speed index on 150 mph. and read opposite 35 minutes 87 miles traveled.
2. SEE FIG. 17. Set 18 deg. on drift scale. Opposite 87 miles on the minute scale read 27.2 miles off course on the miles scale.

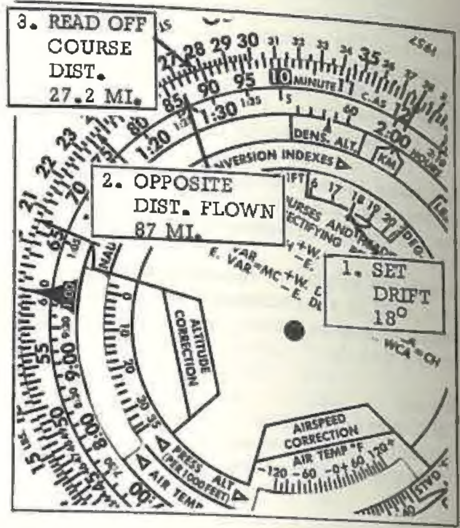


FIG. 17

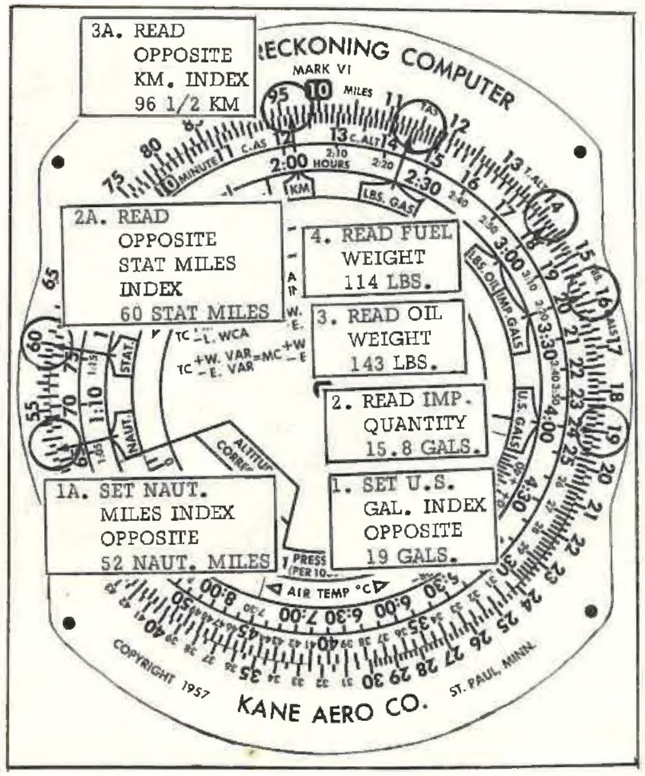


FIG. 18

CONVERSION INDEXES

Indexes are provided on the inner circular scale for rapid conversion of gallons of fuel or oil to pounds, statute miles to nautical miles and miles to kilometers.

Given:
19 U.S. gallons in tank

Find:
Corresponding no. of Imperial gallons, pounds oil and pounds fuel.

Solution: See Fig. 18.
Set U.S. gallons index to 19 on the stationary scale. Read 15.8 Imperial gallons 143 pounds oil and 114 pounds gas opposite corresponding indexes.

Similarly, 52 nautical miles equals 60 statute miles and 96 1/2 kilometers.

COMMON MULTIPLICATION AND DIVISION

Division of two terms may be set up as a proportion similiarly to distance and time to find ground speed except that the answer will be opposite the "10" index instead of the ground speed index.

Example:
Divide 240 by 12

Solution: See Fig. 19.
Align 240 on the fixed miles scale with 12 on the rotating minute scale. Opposite the rotating "10" index find 20 on the miles scale.

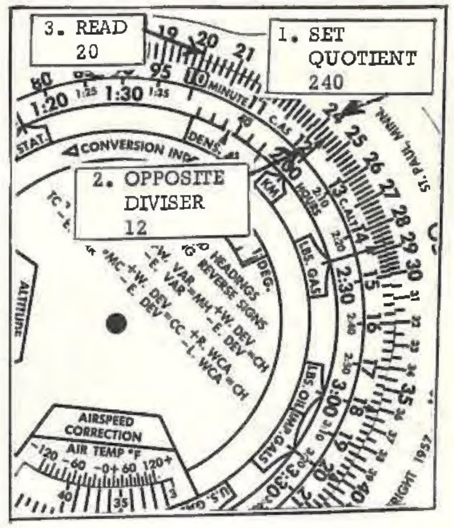


FIG. 19

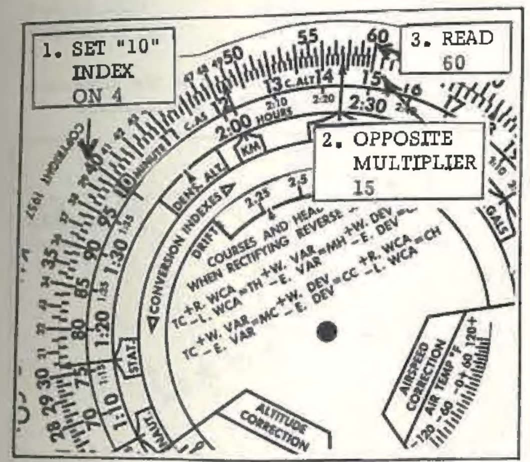


FIG. 20

Multplication of two terms is similiar to solving problems of ground speed and time to find distance, except that the "10" index is used instead of the ground speed index.

Example:
Multiply 4 by 15

Solution: See Fig. 20.
Align the "10" index of the rotating scale opposite 4.0 on the miles scale. Opposite 15 on the minute rotating scale read 60 on the fixed miles scale.

RATE OF CLIMB AND DESCENT

Problems involving rate of climb and descent are solved as ordinary multiplication and division problems using the "10" index as explained above.

Given:
Aircraft rate of climb-800 ft. per minute
Altitude to climb-From 2000 ft. to 14,000 ft.

Find:
Time to ascend to cruising level

Solution: See Fig. 21.
Place "10" index of the rotating scale opposite 800 on the miles fixed scale. Opposite (14,000-2,000) 12,000 on the fixed miles scale read 15 minutes.

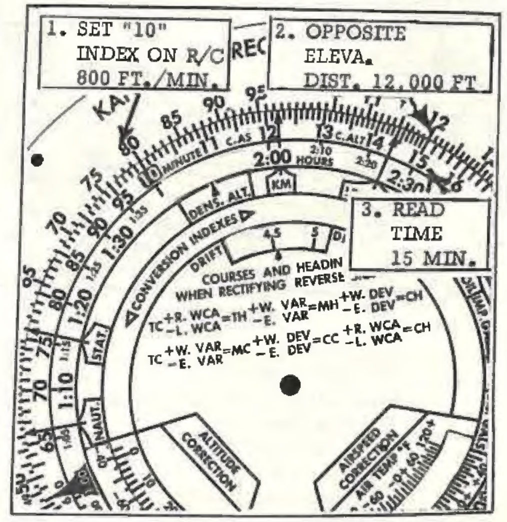


FIG. 21

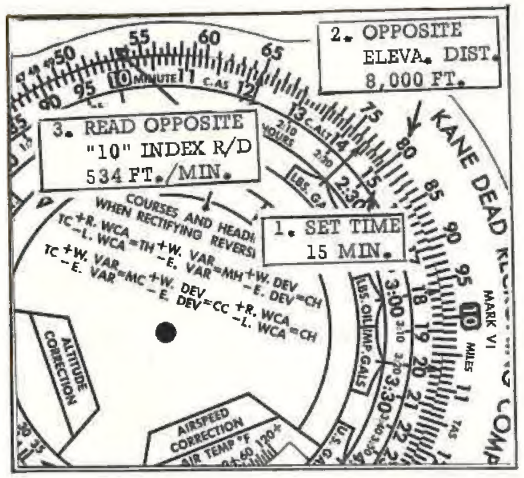


FIG. 22

Given:
An aircraft cruising at 9,000 ft. required 15 minutes to descend to 1,000 ft.

Find:
Rate of Descent

Solution: See Fig. 22.
Align 15 minutes of the rotating scale with (9,000-1,000) 8,000 on the fixed miles scale. Opposite the "10" index of the rotating scale read 534 ft. per minute on the fixed miles scale.

FORMULAS FOR WIND TRIANGLE SOLUTION
(SEE FIGURES 23 AND 24)

Accurate dead reckoning navigation is dependent on the formulas engraved on the slide rule side of the computer. A detailed explanation is contained in Section II of this manual.

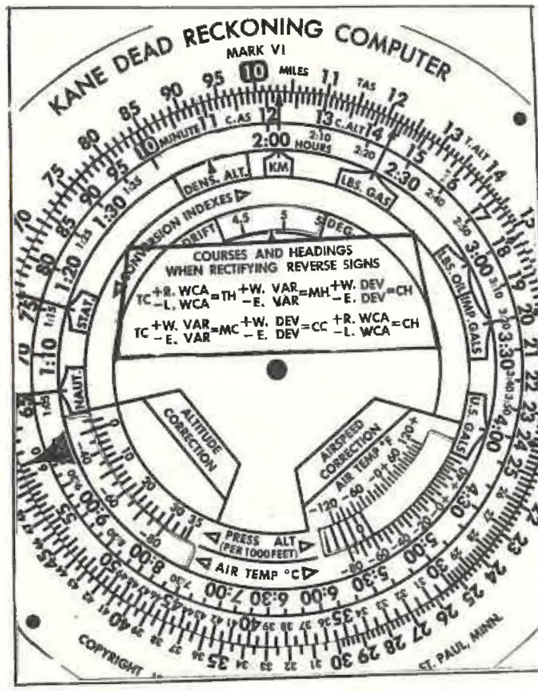


FIG. 23

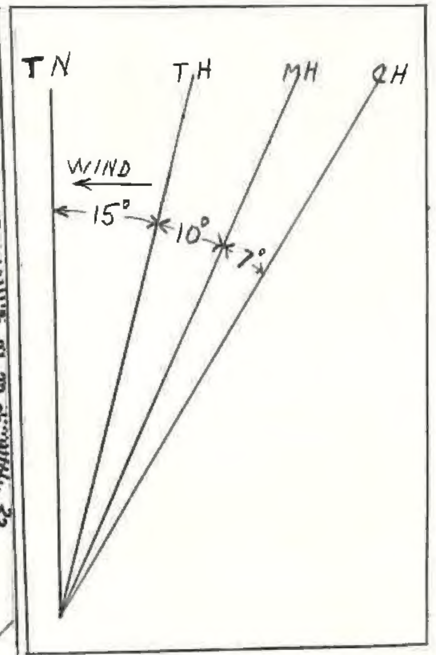


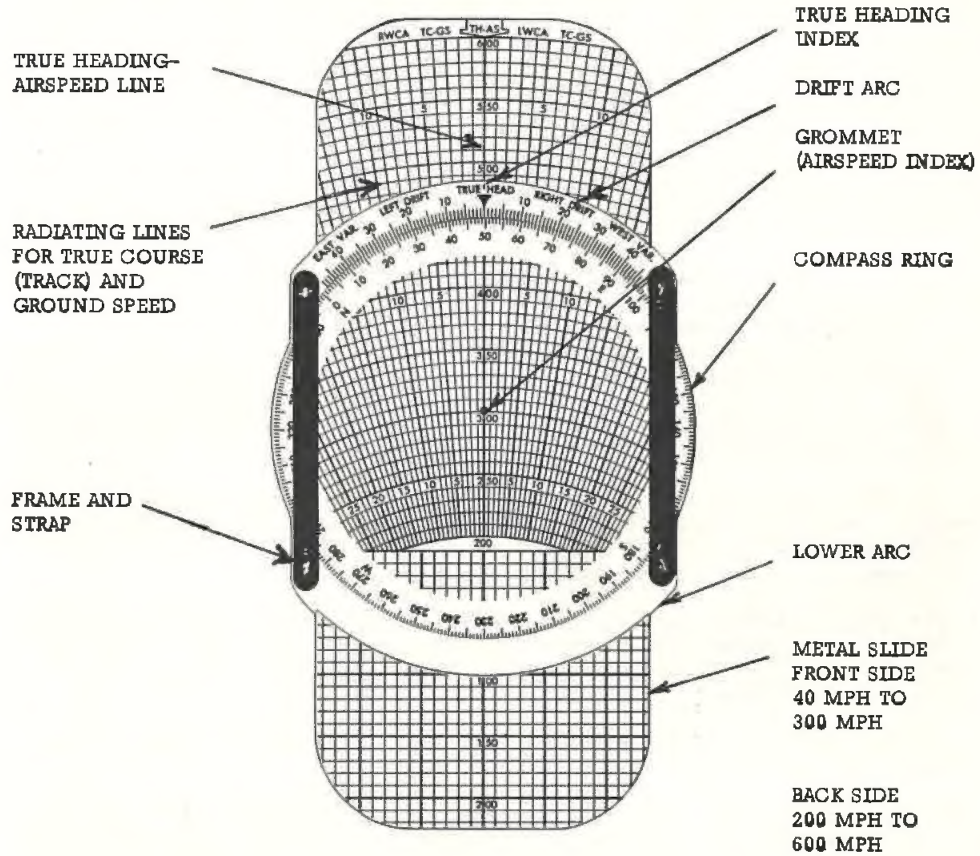
FIG. 24

DEFINITIONS:
TC-True Course
WCA-Wind Correction Angle
TH-True Heading
VAR.-Variation
DEV.-Deviation
CH-Compass Heading
MC-Magnetic Course
CC-Compass Course

To make good a 360 deg. True Course (Track) it is necessary to steer a Compass Heading of 32 deg. (360-15-10-7)

SECTION II - SOLUTION OF WIND VECTOR TRIANGLES

Solution of wind vector triangles is accomplished on the face of the computer using the rotating compass ring and plotting disc. The wind triangle is drawn on the plotting disc. A vector wind triangle is composed of three vectors. A vector has magnitude and direction. The magnitude is usually expressed in miles per hour or knots. The direction of each vector is clockwise of true north. The three vectors dealt with in solution of wind triangles are wind direction and speed, true heading and airspeed, true course (track) and ground speed. Given any combination of four quantities, the other two can be determined.



WIND TRIANGLE SIDE OF COMPUTER

RULES FOR SOLUTION OF WIND TRIANGLES

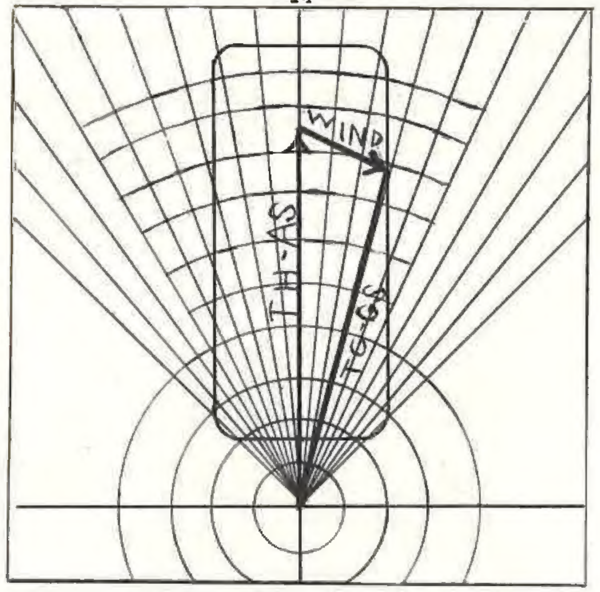
General Information

1. True Heading and Airspeed is a vector quantity. It established one side of the wind triangle. True Heading is the direction in degrees from True North and Airspeed is the length of the line.

2. True Course or Track and Ground Speed is the second vector quantity. It establishes the second side of the triangle.

3. Wind Direction and Speed is a vector quantity and establishes the third side of the wind triangle.

4. Remember that True Heading and Airspeed is on the same line; True Course (Track) and Ground Speed is on the same line; Wind Direction and Speed is on the same line.



5. Use the following order for plotting a wind triangle when possible:
   a. First, plot wind direction and speed.
   b. Secondly, plot True Heading and Airspeed.
   c. Thirdly, plot True Course and Ground Speed.

6. Always draw wind down from the grommet (center of plotting disc). Place an arrow on the outer extremity of the wind vector.

7. True Heading is always under the True Heading Index. True Airspeed is always under the Grommet. The center horizontal line of the slide (card) is always True Heading-Airspeed side of the wind triangle. The origin of the Airspeed line is on the extreme bottom of the slide center line and the other extremity is under the grommet.

8. True Course (Track) and Ground Speed are on the diverging (radiating) lines. The origin of the True Course line is on the extreme bottom center of the slide and the other extremity is along the diverging (radiating) line, terminating at the head of the wind arrow. The wind arrow is always on the Ground Speed.

9. The wind vector has its origin at the grommet (center of plotting disc) and the other extremity of the line terminates at the True Course (Track) line.

10. Consider the airplane headed along the center line of the slide and flying towards the True Heading Index. If the wind arrow strikes the airplane on the right, it will drift to the left of the center line; if it strikes on the left, it will drift to the right of the center line. THE WIND BLOWS THE AIRPLANE FROM HEADING TO TRUE COURSE (TRACK). The drift angle is the angle between the Heading-Airspeed line to True Course-Ground Speed line.

11. True Course is the direction you want to make good. Track is direction you actually make good.

12. True Heading is the direction you point the airplane to compensate for wind drift. The angle the airplane is turned from True Course to True Heading is the Wind Correction Angle. The Wind blows the airplane from True Heading to True Course causing the drift angle. Both angles are equal but opposite in sign.

13. A right wind correction angle (left drift) is added to the True Course to obtain True Heading. Conversely, a left wind correction angle (right drift) is subtracted. Right drift angles are found on the right side of the True Heading-Airspeed line of the slide and left drift angles on the left.

14. Similar corrections are made for Variation and Deviation as for wind. West variation and deviation are added to the True Course to obtain True Heading and conversely east variation and deviation are subtracted.

Formulae for correction of wind, variation and deviation to compute headings and courses:

1. To obtain Compass Heading (CH) from True Course (TC) by correcting for wind, variation and deviation apply the following rule: "EAST IS LEAST; WEST IS BEST". Note that the primary difference between the two formulae below is in the order of correcting for wind variation and deviation.

a.
a. $TC \begin{matrix} + \text{R.WCA} \\ - \text{L.WCA} \end{matrix} = TH \begin{matrix} + \text{W.VAR.} \\ - \text{E.VAR.} \end{matrix} = MH \begin{matrix} + \text{W.DEV.} \\ - \text{E.DEV.} \end{matrix} = CH$

b. $TC \begin{matrix} + \text{W.VAR} \\ - \text{E.VAR.} \end{matrix} = MC \begin{matrix} + \text{W.DEV.} \\ - \text{E.DEV.} \end{matrix} = CC \begin{matrix} + \text{R.WCA} \\ - \text{L.WCA} \end{matrix} = CH$

2. To obtain True Course (TC) from Compass Heading (CH) (Rectifying a Course) reverse the signs e.g., "EAST IS BEST; WEST IS LEAST".

b.
a. $CH \begin{matrix} - \text{W.DEV.} \\ + \text{E.DEV.} \end{matrix} = MH \begin{matrix} - \text{W.VAR.} \\ + \text{E.VAR.} \end{matrix} = TH \begin{matrix} - \text{R.WCA} \\ + \text{L.WCA} \end{matrix} = TC$

b. $CH \begin{matrix} - \text{R.WCA} \\ + \text{L.WCA} \end{matrix} = CC \begin{matrix} - \text{W.DEV.} \\ + \text{E.DEV.} \end{matrix} = MC \begin{matrix} - \text{W.VAR.} \\ + \text{E.VAR.} \end{matrix} = TC$

c. Abbreviations:

TC--True Course
WCA--Wind Correction Angle
TH--True Heading
VAR.--Variation
DEV.--Deviation
CH--Compass Heading
MC--Magnetic Course
CC--Compass Course

Solution of Type I Wind Triangles

Given:
Wind Direction-45 deg.
Wind Speed-20 mph.
True Heading-276 deg.
True Airspeed-130 mph.

Find:
True Course
Ground Speed

Solution: See Fig. 1.
1. Set Wind Direction (45 deg.) opposite True Heading Index by rotating compass ring.

2. Move slide so as to place any convenient whole number under grommet (center of rotating disc).

3. Draw a line from the grommet 20 units (10 spaces) placing an arrow at the end of the wind line.

4. Rotate Compass ring so that the True Heading (276 deg.) is opposite the True Heading Index.

5. Move slide so that the True Airspeed (130 mph.) is under the grommet.

6. Ground Speed (144 mph.) is read at the end of the wind arrow along the speed circle.

7. Since the wind is from the right, the drift is left (6 deg.). The end of the wind arrow is 6 spaces to the left of the True Heading-Airspeed line.

8. Opposite 6 divisions to the left of the True Heading Index, read True Course (270 deg.).

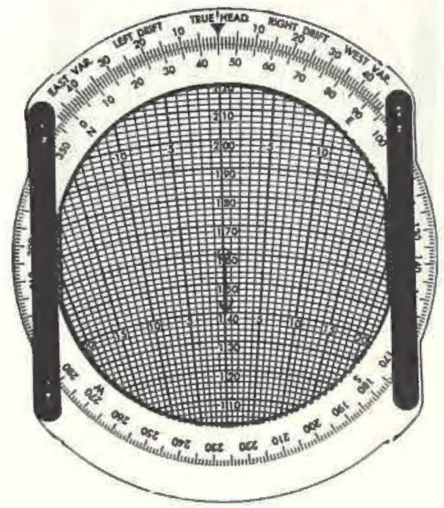


FIG. 1a

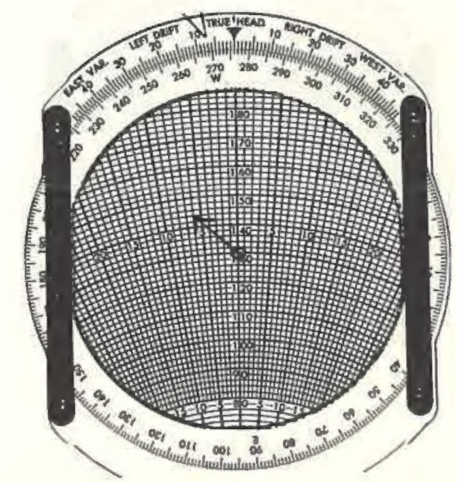


FIG. 1b

PRACTICE PROBLEMS FOR TYPE I. WIND TRIANGLES

Exercise 1.

No.	Wind Direction (Deg.)	Wind Speed (MPH)	True Heading (Deg.)	True Airspeed (MPH)	True Course (Deg.)	Ground Speed (MPH)	WIND DRIFT (Deg.)
1.	90	30	350	120	( )	( )	( )
2.	50	20	260	130	( )	( )	( )
3.	270	25	180	125	( )	( )	( )
4.	300	22	360	110	( )	( )	( )
5.	225	18	45	150	( )	( )	( )
6.	360	30	100	135	( )	( )	( )
7.	325	26	37	117	( )	( )	( )
8.	180	27	90	128	( )	( )	( )
9.	360	12	299	130	( )	( )	( )
10.	360	11	86	92	( )	( )	( )

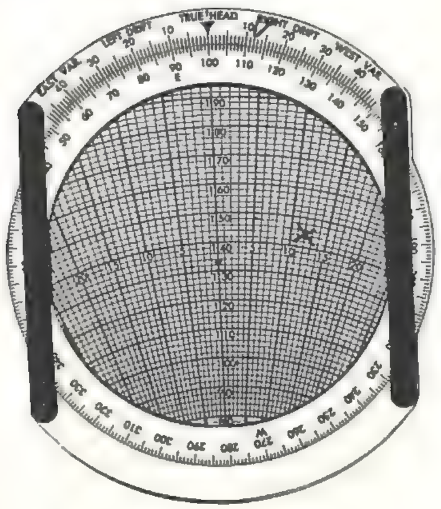


FIG. 2a

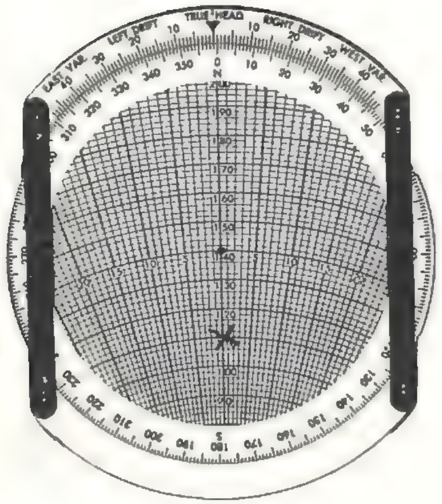


FIG. 2b

Solution of Type II. Wind Triangles

Given:
True Heading-100 deg.
True Airspeed-135 mph.
True Course-112 deg.
Ground Speed-144 mph.

Find:
Wind Direction
Wind Speed

Solution: See Fig. 2.

1. Rotate compass ring so that True Heading (100 deg.) appears under True Heading Index.

2. Move slide so that True Airspeed (135 mph) appears under the grommet.

3. Compute the drift angle by subtracting T.C. (True Course) from T.H. (True Heading). If T.H. (True Heading) is greater than T.C. (True Course), the drift is left and if T.H. (True Heading) is less than T.C. (True Course) the drift is right. REMEMBER THAT YOU HEAD THE AIRPLANE INTO THE WIND FROM TRUE COURSE. IF YOU HEAD TO THE RIGHT TO COMPENSATE FOR A RIGHT WIND, THE DRIFT WILL BE LEFT, AND THE TRUE HEADING WILL BE GREATER THAN THE TRUE COURSE.

3a. Alternate method of determining Drift. The T.C. (True Course) is 112 degrees appears on the right drift side of the compass ring with respect to the T.H. (True Heading Index) of 100 degrees. Accordingly, the drift is right. The wind arrow will appear on the right side of the drift arc. Determine the difference between T.H. (True Heading) and T.C. (True Course). In this example it is 12 degrees.

4. Count off 12 deg. R.D. to the right of the True Heading-Airspeed line along ground speed circle of 144 mph. and place a cross. The line from grommet to cross represents the wind direction and speed.

5. Rotate the compass ring so that the cross appears on the True Heading-Airspeed line below the grommet.

6. Move the slide to any convenient whole number under the grommet.

7. Read Wind Direction (359 deg.) under the True Heading Index.

8. Read Wind Speed by counting the units (30 mph.) from the grommet to cross.

PRACTICE PROBLEMS FOR TYPE II. WIND TRIANGLES

Exercise 2.

No.	Wind Direction (Deg.)	Wind Speed (MPH)	Wind Drift (Deg.)	True Heading (Deg.)	True Airspeed (MPH)	True Course (Deg.)	Ground Speed (MPH)
1.	( )	( )	( )	80	120	90	100
2.	( )	( )	( )	355	135	360	130
3.	( )	( )	( )	45	118	38	128
4.	( )	( )	( )	192	150	183	137
5.	( )	( )	( )	95	165	103	178
6.	( )	( )	( )	270	65	263	72
7.	( )	( )	( )	158	68	158	78
8.	( )	( )	( )	87	78	87	63
9.	( )	( )	( )	285	85	270	94
10.	( )	( )	( )	183	155	180	161

Solution of Type III. Wind Triangles

Given:
Wind Direction-260 deg.
Wind Speed-50 mph.
True Course (Track)-240 deg.
True Airspeed-150 mph.

Find:
True Heading
Ground Speed

Solution: See Fig. 3.

1. Rotate compass ring to Wind Direction (260 deg.) opposite True Heading Index.

2. Move slide to any convenient whole number under the grommet (center of disc).

3. Draw a line down from the grommet 50 units in length to represent the Wind speed and place an arrow at its end (end furthest from grommet).

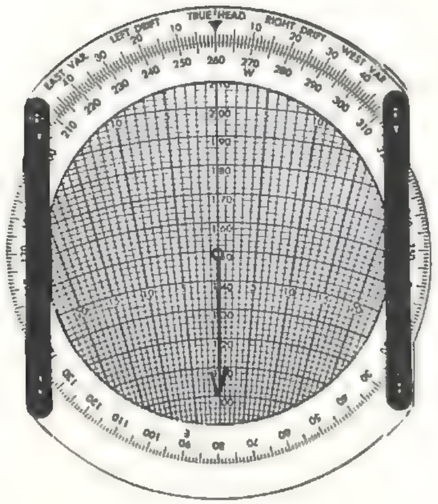


FIG. 3a

4. Place the grommet on the True Airspeed (150 mph.) by moving the slide.

5. Place the True Course (240 deg.) opposite the True Heading Index and draw an arrow on the compass ring at this position.

6. Obviously step No. 5 is incorrect since the True Course has been placed under the True Heading Index, but this may be done to obtain a first approximation of the True Heading (T.H.). Under this condition read the drift angle (9 1/2 deg. L.D.) at the end of the wind arrow. (See Fig. 3b).

7. A left drift (9 1/2 deg.) is a right wind correction to the True Course (240 deg.) and is added. The second True Heading (T.H.-2) becomes 249 1/2 deg. Place the second True Heading (249 1/2 deg.) under the True Heading Index, which is the same as rotating the compass ring (9 1/2 deg.) to the left of the True Heading Index.

8. Obviously the second True Heading is incorrect since five degrees appears on the slide at the wind arrow. To be correct the arc drift value should be equal to the drift on the slide at the wind arrow.

9. Finally rotate the compass ring back and forth until the drift angle on the drift arc opposite the True Course (240 deg.) is equal to the drift on the slide at wind arrow. This occurs at 6 1/2 deg. See Fig. 3c.

10. Read True Heading at the True Heading Index (246 1/2 deg.).

11. Read Ground Speed at the wind arrow (102 mph.).

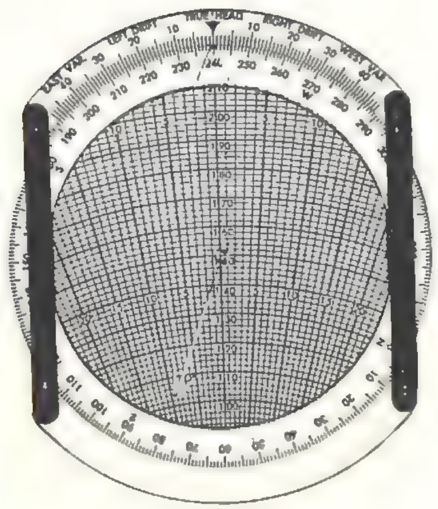


FIG. 3b

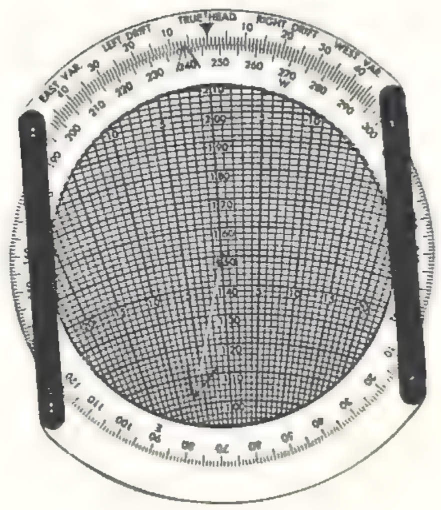


FIG. 3c

PRACTICE PROBLEMS FOR TYPE III. WIND TRIANGLES

Exercise 3.

No.	Wind Direction (Deg.)	Wind Speed (MPH)	True Heading (Deg.)	True Airspeed (MPH)	True Course (Deg.)	Ground Speed (MPH)
1.	320	30	( )	140	260	( )
2.	50	25	( )	120	250	( )
3.	45	20	( )	130	270	( )
4.	90	32	( )	150	180	( )
5.	180	28	( )	125	90	( )
6.	240	22	( )	160	300	( )
7.	50	30	( )	174	315	( )
8.	270	27	( )	180	360	( )
9.	180	32	( )	92	45	( )
10.	270	30	( )	120	90	( )

PRACTICE PROBLEMS FOR TYPE I, II, AND III, WIND TRIANGLES

MIXED SERIES

Exercise 4.

No.	Wind Direction (Deg.)	Wind Speed (MPH)	True Heading (Deg.)	True Airspeed (MPH)	True Course (Deg.)	Ground Speed (MPH)	Drift Angle (Deg.)
1.	270	32	?	125	135	?	?
2.	250	25	?	140	90	?	?
3.	92	22	183	135	?	?	?
4.	184	18	350	105	?	?	?
5.	?	?	285	150	270	165	?
6.	?	?	180	90	188	75	?
7.	155	15	?	145	180	?	?
8.	175	20	180	125	?	?	?
9.	?	?	255	100	265	88	?
10.	186	25	?	140	152	?	?
11.	180	25	?	192	270	?	?
12.	350	?	90	125	?	?	8 R
13.	270	?	180	150	?	?	10 L
14.	270	25	?	?	350	120	
15.	45	20	?	?	90	150	

SPECIAL TYPE OF WIND TRIANGLES

Given:
Wind Velocity-260 deg/50 mph
True Course-240 deg.
Ground Speed-110 mph.

Find:
True Heading
True Airspeed

Solution: See Fig. 4.
1. Plot Wind Velocity as in Fig. 3a.
2. Rotate compass ring so that the True Course (240 deg.) is opposite the True Heading Index and place an arrow on the compass ring at 240 deg.
3. Obviously step No. 2 is incorrect since the True Course has been placed under the True Heading Index but this may be done to obtain a first approximation of the True Heading (T.H.)

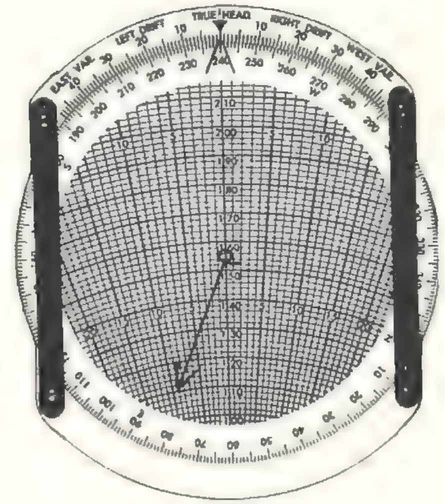


FIG. 4a

4. Move the slide until the Ground Speed (110 mph.) is at the wind arrow.
5. Read the Drift Angle at the end of the wind arrow (9 deg. left drift).
6. A left drift (right wind correction angle) is added to the True Course (240 deg.) to obtain the second True Heading (T.H.-2-249 deg.).
Alternate Method: Place T.C. 240 deg. opposite 9 deg. on the left drift portion of the arc.
7. Move slide so that the Ground Speed (110 mph.) is at the wind arrow.
8. Obviously this triangle is still incorrect since a True Heading of 249 deg. minus 5 deg. drift on slide is not equal to the True Course of 240 deg. Alternately, the drift on the arc is not equal to the drift on the slide.

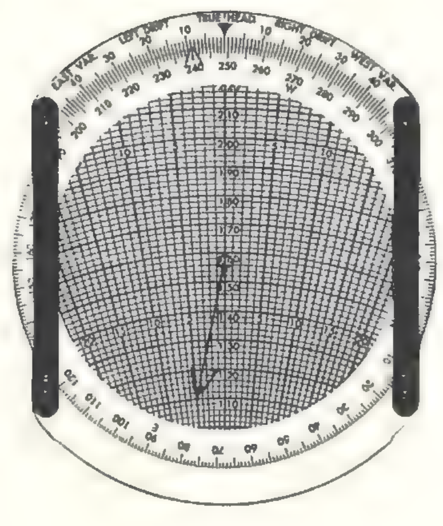


FIG. 4b

9. Finally rotate the compass ring back and forth until the drift angle on the drift arc opposite the True Course (240 deg.) is equal to the drift on the slide. This occurs at 6 1/2 deg.
Note: At each trial setting move the slide so that the wind arrow is on the Ground Speed (110 mph.).

10. Read True Heading at the True Heading Index (246 1/2 deg.).

11. Read Air Speed on the grommet (158 mph.)
Note: See Page 23 for Practice Problems.

DRIFT ON MULTIPLE HEADINGS

Problems involving drift on multiple headings depend on the use of a driftmeter.

Given:
TH-1,-50; TAS-1,-150 MPH; DRIFT 6 DEG. L
TH-2,-180; TAS-2,-140 MPH; DRIFT 5 DEG. R

Find:
1. Wind Direction and Speed
2. Ground Speed on each Heading

Solution: See Fig. 5.
1. Place TH-1 (50 deg.) at the True Heading Index and TAS-1 (150 mph.) under the grommet. (See Fig. 5a)

2. Draw a track line on the plotting disc 6 deg. to the left of the card heading line.

3. Place TH-2 (180 deg.) at the True Heading Index and TAS-1 (140 mph.) under the grommet.

4. Draw a track line on the plotting disc 5 deg. to the right of the card heading line intersecting the first drift line. (See Fig. 5b)

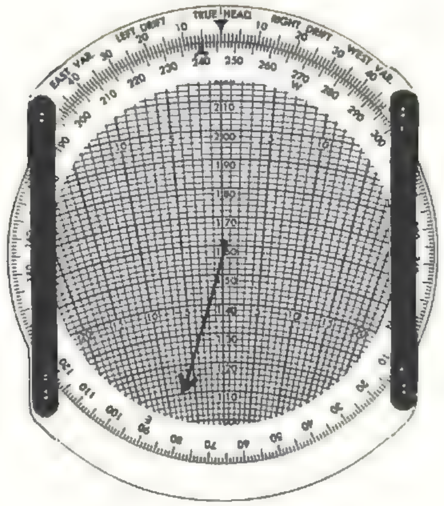


FIG. 4c

5. Read the Ground Speed (130 mph) on this heading at the intersection of the drift lines.

6. Rotate the compass disc so that the intersection of the two drift lines are below the grommet on True Heading line of the slide.

7. Read Wind Direction (135 deg.) under the True Heading Index. (See Fig. 5c)

8. Read the wind speed (15 mph.)

9. Place TH-1 (50 deg.) at the True Heading Index and TAS-1 (150 mph.) under the grommet. (See Fig. 5d)

10. Read GS-1 (149 mph.) at the drift line intersection.

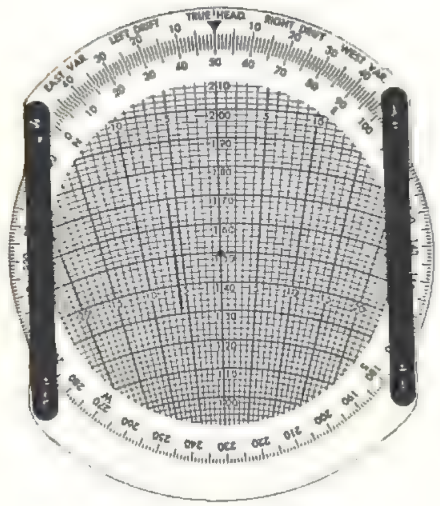


FIG. 5a

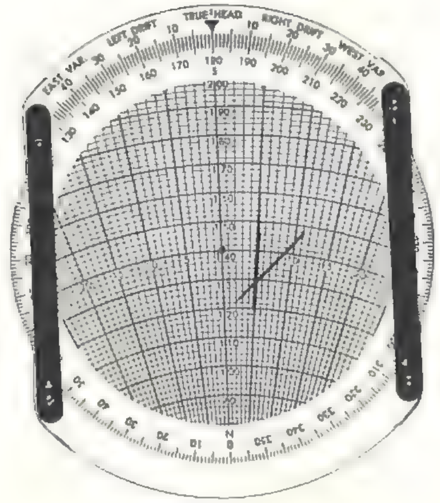


FIG. 5b

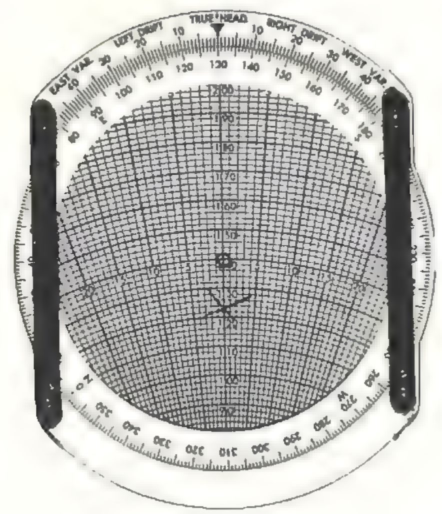


FIG. 5c

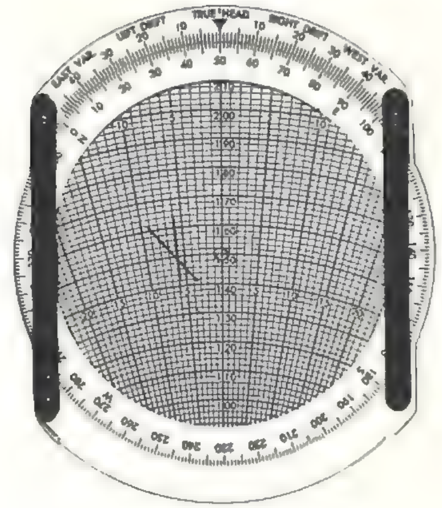


FIG. 5d

MULTIPLE DRIFT PRACTICE PROBLEMS

Exercise 5.

No.	TAS MPH	TH-1 DEG.	Drift-1 Deg.	TH-2 DEG.	Drift-2 Deg.	W.D. Deg.	W.S. MPH	G.S.-1 MPH	G.S.-2 MPH
1.	96	134	6R	46	14L	( )	( )	( )	( )
2.	145	259	12R	169	10R	( )	( )	( )	( )
3.	125	360	15R	90	10L	( )	( )	( )	( )
4.	150	100	4R	200	0	( )	( )	( )	( )
5.	140	360	7L	300	4L	( )	( )	( )	( )
6.	120	270	3R	200	8L	( )	( )	( )	( )
7.	160	85	2L	135	10R	( )	( )	( )	( )
8.	120	45	0	90	10L	( )	( )	( )	( )

HALF SCALE WIND TRIANGLES

Given:
True Heading-180 deg.
True Airspeed-240 mph.
True Course-160 deg.
Ground Speed-260 mph.

Find:
Wind Direction
Wind Speed

Note: Solving this problem as a conventional type II problem will take you off the face of the plotting disc. To solve this problem with a Kane Mark VI computer, use half scale for all speed quantities.

Caution-1: Do not half scale the angles.
Caution-2: Since half scale is used, double the wind speed quantity when determined.

Solution: See Fig. 6.
1. The difference between True Course (160 deg.) and True Heading (180 deg.) is +20 deg.

2. Since the airplane must be headed further to the right by 20 deg. from a True Course of 160 deg., the wind must be from the right.

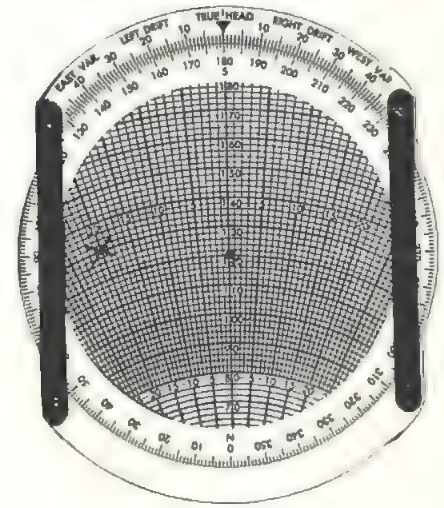


FIG. 6a

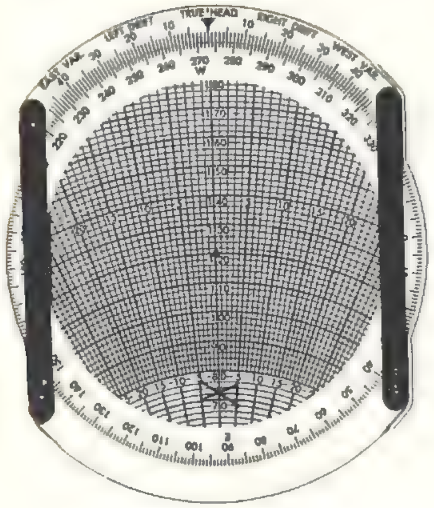


FIG. 6b

3. A right wind correction angle (20 deg.) will cause a left drift.

4. Place True Heading (180 deg.) under True Heading Index.

5. The True Airspeed (240 mph.) half scale is 120 mph.

6. Place grommet over Airspeed (120 mph.).

7. The Ground Speed (260 mph.) half scale is 130 mph.

8. Where the speed circle 130 intersects the 20 deg. left drift Track line, place a cross.

9. Rotate the compass ring so that the cross coincides with True Heading-Airspeed line and is below the grommet.

10. Count wind speed units (45 mph.) down from the grommet.

11. Doubling the wind quantity (45 mph.) is 90 mph.

12. Read wind direction (273 deg.) at the True Index.

Exercise 6.

No.	Wind Direction (Deg.)	Wind Speed (MPH)	Drift Angle (Deg.)	True Heading (Deg.)	True Airspeed (MPH)	True Course (Deg.)	Ground Speed (MPH)
1.	( )	( )	( )	70	180	90	160
2.	( )	( )	( )	250	140	275	100
3.	( )	( )	( )	18	185	360	200
4.	( )	( )	( )	153	145	175	102
5.	( )	( )	( )	170	110	150	150

RADIUS OF ACTION WIND TRIANGLES

Given:
Wind Direction-310 deg.
Wind Speed-20 mph.
True Course out-90 deg.
True Airspeed-120 mph.

Find:
1. True Heading out
2. Ground Speed out
3. True Heading back
4. True Course back
5. Ground Speed back

Solution: See Fig. 7.
1. Set up wind triangle as in type III problems.

2. Read True Heading out (84 deg.) at the True Heading Index.

3. Read Ground Speed out (135 mph.) at the end of the wind arrow.

4. Draw a Track line along the 6 deg. drift line.

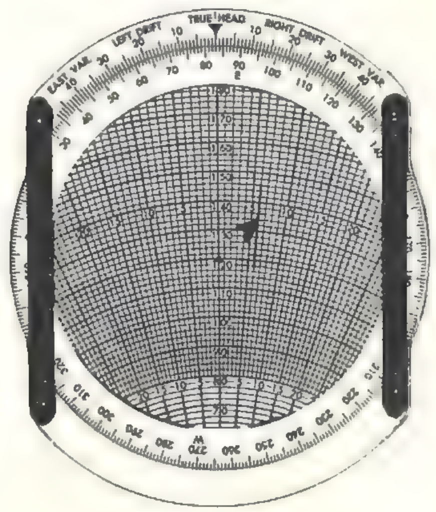


FIG. 7a

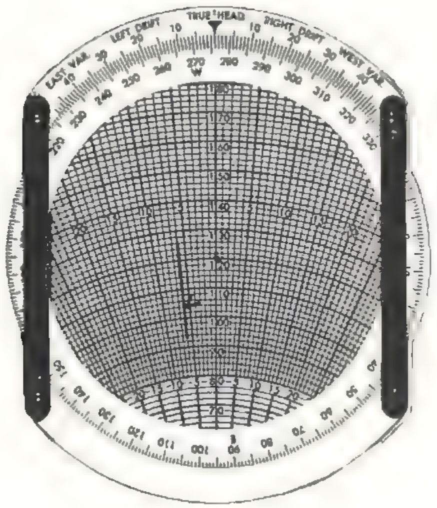


FIG. 7b

5. For the return trip rotate compass ring until True Course (Track) out parallels a track line, on the opposite drift side of the computer.
Note: If True Course out was right drift (6 deg.), the reciprocal course (True Course back), would be left drift (6 deg.).

6. Read True Heading back (276 deg.) at True Heading Index.

7. Read Ground Speed back (104 mph.) at the end of the wind arrow.

8. Drift for the return trip is 6 deg. left.

9. Opposite 6 units to the left of the True Heading Index, read True Course back (270 deg.) on compass ring.
Note: True Course out plus or minus 180 deg. is equal to True Course back.

RADIUS OF ACTION PROBLEMS

Exercise 7.

No.	Wind Dir.	Wind Speed	True Head. Out	True Head. Back	True A.S.	T.C. Out	T.C. Back	G.S. Out	G.S. Back
1.	45	20	( )	( )	120	270	( )	( )	( )
2.	110	25	( )	( )	135	360	( )	( )	( )
3.	360	30	( )	( )	125	45	( )	( )	( )
4.	225	28	( )	( )	140	180	( )	( )	( )
5.	20	15	( )	( )	95	120	( )	( )	( )

PRACTICE PROBLEMS FOR SPECIAL TYPE OF WIND TRIANGLES
(SEE PAGE 19 FIG. 4.)

Exercise 8.

No.	Wind Direction (Deg.)	Wind Speed (MPH)	True Heading (Deg.)	True Airspeed (MPH)	True Course (Deg.)	Ground Speed (MPH)
1.	270	25	( )	( )	45	150
2.	180	32	( )	( )	250	165
3.	360	18	( )	( )	110	125
4.	95	30	( )	( )	185	140
5.	45	28	( )	( )	350	110

OFF COURSE PROBLEMS

Given:
Off Course-6 miles
Distance Flown-60 miles
Distance remaining-120 miles

Find:
1. Correction angle to parallel course
2. Correction angle to converge on destination
3. Total correction angle to converge on destination

Note: A drift of one mile off course in 60 miles of flight results in approximately 1 deg. drift. If you drift 6 miles off course in 60 miles flown, the drift angle is 6 deg. Three miles drift in 30 miles of flight is 6 deg. drift. Proportionate triangles of drift can be solved on the plotting disc using the grid portion of the slide.

Solution: See Fig. 8.
Note: This problem can be solved more easily on the slide rule side of the computer. An auxiliary drift scale has been provided for this purpose. However, the problem can be solved graphically as illustrated below.

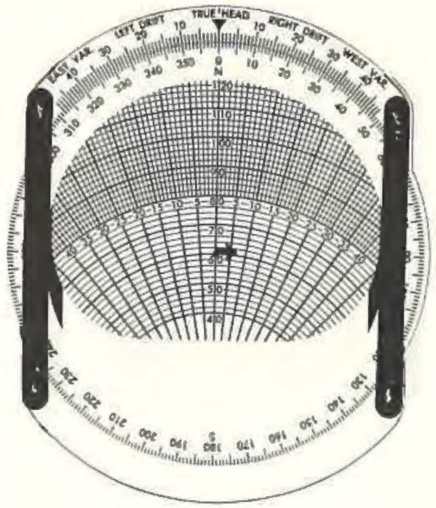


FIG. 8a

1. Place 0, 90, 180 or 270 deg. under True Heading Index.

2. Move the slide to any whole number under the grommet.

3. Draw a line down from the grommet equal to the off course distance (6 miles).

4. Rotating compass ring 90 deg. (See Fig. 8a)

5. Move slide placing grommet under distance flown (60 miles).

6. Read correction to parallel course (6 deg.).

7. Move slide placing grommet on distance left to fly (120 miles). (See Fig. 8b)

8. Read angle to converge on destination (3 deg).

9. To determine total correction to converge on destination, add angle to parallel original course (6 deg.) and angle to converge (3 deg.).

10. If the drift was to the right of the intended course, the heading should be altered to the left by 9 deg. in order to arrive at the destination from the off course position.

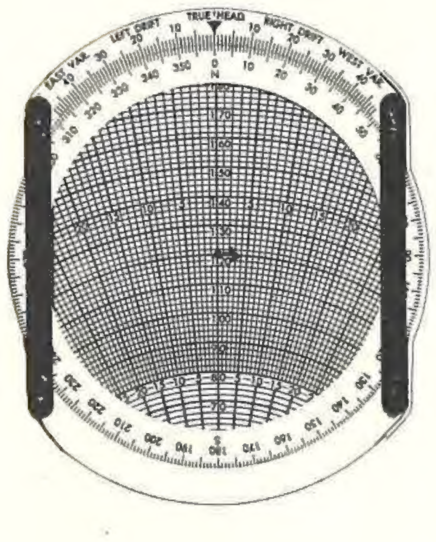


FIG. 8b

OFF COURSE PROBLEMS

Exercise 9.

No.	Miles Off Course	Miles Out	Miles Left	Angle to Parallel	Angle to Converge	Total Correction Angle
1.	8 R	100	150	( )	( )	( )
2.	10 R	125	175	( )	( )	( )
3.	12 L	60	100	( )	( )	( )
4.	15 L	75	50	( )	( )	( )
5.	6 R	96	66	( )	( )	( )

ANSWERS, SECTION I

Exercise 1.

No.	G.S. (MPH)
1.	120
2.	40
3.	120
4.	191
5.	55
6.	130
7.	90
8.	73
9.	145
10.	54

Exercise 2.

No.	Time
1.	1:20
2.	2:00
3.	2:00
4.	:40
5.	:30
6.	:30
7.	2:00
8.	1:17
9.	2:37
10.	:34 1/2

Exercise 3.

No.	Dist. (Miles)
1.	60
2.	45
3.	170
4.	230
5.	90
6.	290
7.	320
8.	36.7
9.	83.5
10.	9.1

Exercise 4.

No.	Dist. (Mi.)	Time	G.S. (MPH)	No.	Dist. (Mi.)	Time	G.S. (MPH)	No.	Dist. (Mi.)	Time	G.S. (MPH)
1.			70	8.	82 1/2			15.		:04	
2.			78	9.	181			16.	12.8		
3.			159	10.			108	17.		1:40	
4.		:36		11.		:43		18.			116
5.		:16 1/2		12.	75			19.		1:12	
6.		:17 1/2		13.		:45		20.		1:24	
7.	180			14.			85				

Exercise 5.

No.	Rate Cons. (GPH)
1.	10.5
2.	10.3
3.	9.8
4.	13.9
5.	9.1

Exercise 6.

No.	Time
1.	5:15
2.	4:40
3.	5:42
4.	2:36
5.	2:41

Exercise 7.

No.	Fuel Cons. (Gals.)
1.	18
2.	21
3.	47
4.	13.7
5.	9.9

Exercise 8.

No.	Fuel (Gals.)	Time	Rate (GPH)	No.	Fuel (Gals.)	Time	Rate (GPH)
1.			9	11.	15.6		
2.			7.7	12.		3:10	
3.		2:45		13.			13
4.		3:12		14.			18.8
5.	21			15.		3:44	
6.	38.5			16.			12.5
7.		3:00		17.	21		
8.			16.1	18.	16.9		
9.		2:40		19.			7.4
10.	33			20.			9.6

Exercise 9.

No.	T. Alt.
1.	20,400
2.	9,800
3.	31,800
4.	10,550
5.	6,250
6.	14,950
7.	4,730
8.	19,100
9.	8,300
10.	11,700

Exercise 10.

No.	Air Temp.
1.	-37
2.	-25
3.	-14
4.	-16
5.	+ 3
6.	-25

Exercise 11.

No.	Ind. Alt.
1.	18,700
2.	9,250
3.	8,800
4.	15,400
5.	5,100
6.	6,000

Exercise 12.

No.	T.A.S.	No.	T.A.S.
1.	208	6.	146
2.	272	7.	139
3.	156	8.	227
4.	192	9.	206
5.	146	10.	215

Exercise 13.

No.	I.A.S.
1.	124
2.	145
3.	117
4.	119
5.	123
6.	99.5

Exercise 14.

No.	Ind. Alt.
1.	9,500
2.	4,000
3.	9,500
4.	2,000
5.	4,200
6.	6,000

Exercise 15.

No.	IAS	IND. ALT.	TEMP.	TAS.	No.	IAS	IND. ALT.	TEMP.	TAS
1.			-15		6.			+40	
2.				210	7.				190
3.		12,300			8.	123			
4.	202				9.			-45	
5.		5,000			10.		3,000		

CONT. SECTION I ANSWERS

Exercise 16.

No.	Angle to Parallel	Angle to Converge	Total Correction Angle
1.	4.6L	3.2L	7.8L
2.	4.6L	3.3L	7.9L
3.	11.5R	6.8R	18.3R
4.	11.5R	17.5R	29 R
5.	3.6L	5.2L	8.8L

Exercise 1.

No.	T.C.	G.S.	W.D.
1.	337	129	13L
2.	256	148	4L
3.	169	127	11L
4.	11	101	11R
5.	45	168	0
6.	112	143	12R
7.	50	112	13R
8.	78	131	12L
9.	294	125	5L
10.	93	92	7R

Exercise 2.

No.	W.D.	W.S.	W.D.
1.	41	28	10R
2.	292	13	5R
3.	165	18	7L
4.	248	26	9L
5.	340	27	8R
6.	37	11	7L
7.	338	10	0
8.	87	15	0
9.	28	25	15L
10.	308	10	3L

Exercise 3.

No.	T.H.	G.S.
1.	271	123
2.	254	144
3.	276	144
4.	168	147
5.	103	122
6.	293	148
7.	325	174
8.	350	178
9.	60	112
10.	90	150

Exercise 4.

No.	WD.	WS.	T.H.	T.A.S.	T.C.	G.S.	Drift
1.			145			146	10L
2.			93			163	3L
3.					192	137	9R
4.					352	123	2R
5.	27	44					15L
6.	147	19					8R
7.			177			131	3R
8.					181	105	1R
9.	206	20					10R
10.			158			119	6L
11.			262			190	8R
12.		18			98	129	
13.		26			170	152	
14.			339	127			
15.			85	165			

Exercise 5.

No.	W.D. (Deg.)	W.S. (MPH)	G.S.-1 (MPH)	G.S.-2 (MPH)
1.	112	23	74	90
2.	140	41	168	112
3.	235	50	160	169
4.	20	10	148	161
5.	82	16	139	154
6.	255	18	103	110
7.	92	35	125	136
8.	225	36	156	148

Exercise 6.

No.	W.D.	Ws	Drift
1.	10	62	20R
2.	209	64	25R
3.	113	62	18L
4.	115	64	22R
5.	291	60	20L

Exercise 7.

No.	THO	THB	TCB	GSO	GSB
1.	276	83	90	135	104
2.	10	171	180	141	124
3.	35	235	225	101	144
4.	188	351	359	119	159
5.	110	308	300	96	91

Exercise 8.

No.	T.H.	T.A.S.
1.	37	134
2.	240	179
3.	101	120
4.	173	143
5.	1	129

Exercise 9.

No.	Ang to Par	Ang to Conv	Total
1.	5L	3L	8L
2.	4L	3L	7L
3.	11R	7R	18R
4.	11R	17R	28R
5.	4R	5 L	9L

COMPANION AERIAL NAVIGATION PRODUCTS

KANE AVIGATION PLOTTER
MARK IV

The Mark IV plotter is acclaimed the greatest advancement in plotter design. It is precision engineered-simple to operate-and crystal clear. The dimensions are 16 X 32 X 3/16 inches. Heat warpage and usage scratching has been virtually eliminated by the use of a molded high temperature lucite plastic. The markings have been molded into the underside of the plotter to provide long lasting, ease of reading and elimination of parallax error. The plotter is designed for Sectional and WAC Charts. It has four miles scales. The outer scales are for statute miles and the center scales for nautical miles. The principle design feature of this plotter is based on locating the base of the protractor to coincide with the course line edge of the plotter.

The advantages of this feature are:

1. Reduction in number of steps to plot or measure a course line.

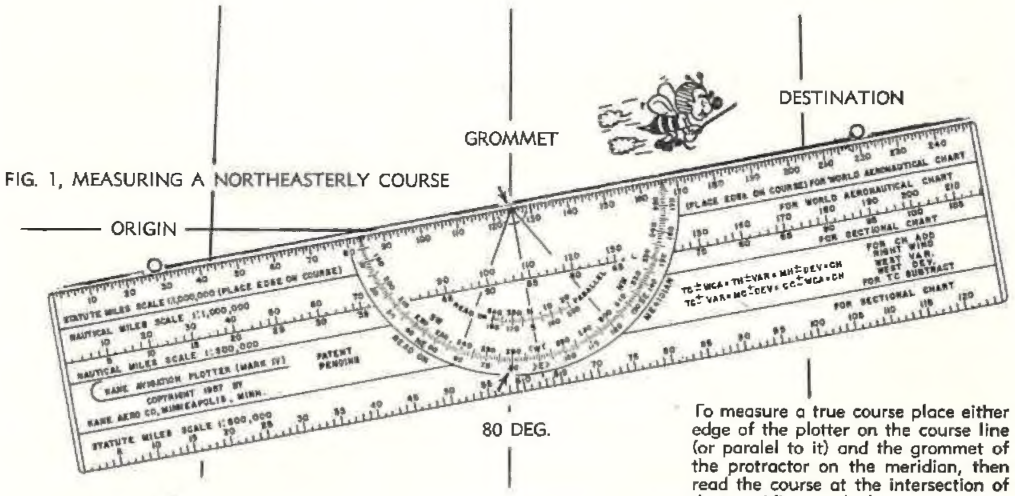
2. Larger diameter protractor without increasing the plotter width.

3. Easier and more accurate alignment of course line with plotter edge and protractor base since the latter two elements coincide.

4. Easier and more accurate reading of protractor scales. Courses may be read on meridians or parallels as convenient.

The plotter is shipped in a top grain leather case and with directions.

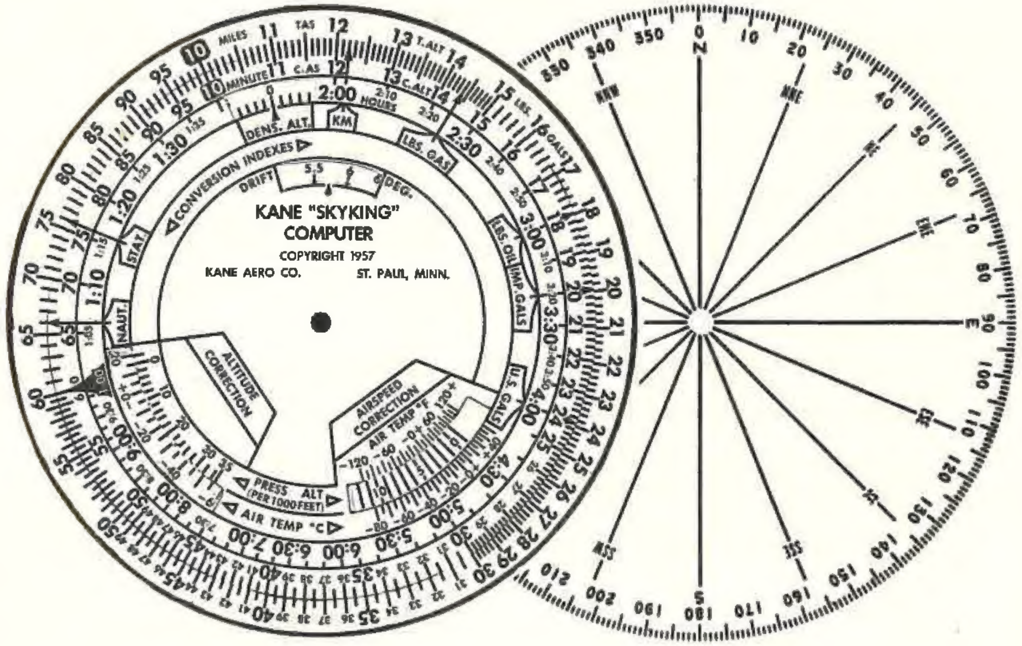
FIG. 1, MEASURING A NORTHEASTERLY COURSE



To measure a true course place either edge of the plotter on the course line (or paralel to it) and the grommet of the protractor on the meridian, then read the course at the intersection of the meridian and the proper outer scale.

COMPANION AERIAL NAVIGATION PRODUCTS

KANE "SKYKING" COMPUTER



The Kane "Skyking" computer was designed for pilots who desire a simple and dependable pocket size computer for aerial work.

It contains all the features of the Kane Mark VI except the capability of solving wind triangles.

Off course correction problems are easily accomplished by the use of an auxiliary drift scale. Airspeed-altitude corrections are solved directly using either Centigrade or Fahrenheit temperature.

An auxiliary density scale permits the solution of problems involving engine and aircraft performance. Indexes are provided for rapid conversion of gallons of fuel or oil to pounds, statute miles to nautical miles and miles to kilometers.

All markings are precision engraved on satin polished aluminum alloy discs.

A lifetime of dependable service can be expected from this precision instrument.

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QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE

ALTERNATE SOLUTION FOR TYPE III WIND TRIANGLE PROBLEMS SEE PAGE 17

NOTE: When this method is used the center line of the slide becomes the True Course or Track and the radiating lines becomes the True Heading line. The wind is drawn down along the slide center line to the Grommet. The tail of the wind arrow (cross) is placed on the airspeed; the ground speed will be found under the Grommet at the end of the wind arrow. The Right Drift portion of the arc becomes a Left Drift or a right wind correction angle (RWCA) and is added to the True Course to obtain True Heading. The True Course is placed under the True Heading Index. Accordingly, the True Heading of triangle is read to the right or left of the True Heading Index by adding or subtracting the wind correction angle.

Given:
Wind Direction-260 deg.
Wind Speed-50 mph.
True Course (Track)-240 deg.
True Airspeed-150 mph.

Find:
True Heading
Ground Speed

Solution: See Fig. 9a
1. Rotate compass ring to wind direction (260 deg.) opposite True Heading Index.

2. Move slide to any convenient whole number under the grommet (center of disc).

3. Draw the wind vector down along the center line to the center of disc or grommet of the proper length representing the wind speed (50 mph).
Note: The head of the wind arrow is placed on the grommet; the tail of the wind is represented by a cross.

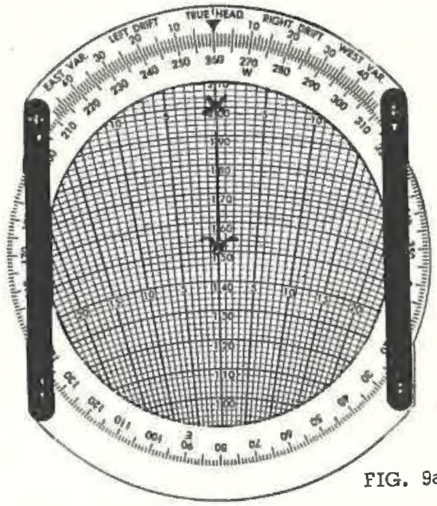

FIG. 9a

4. Place the True Course (240 deg.) opposite the True Heading Index. See Fig. 9b

TH-246 1/2

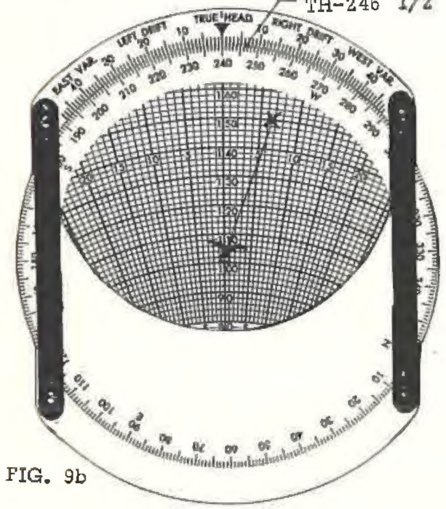

FIG. 9b

5. Move the slide until the tail of the wind vector is on the speed circle for the True Air Speed (150 mph).

6. Read the Ground Speed under the Grommet (102 mph).

7. Read the drift correction angle (6 1/2 deg. right).
Note: When this alternate method of solution is used drift is from the radiating lines to the center line of the slide. Also the true value for the drift correction is reversed. Therefore, Right Drift indicated on the arc becomes Left Drift. A Right wind correction angle is added to the True Course to obtain the True Heading. Accordingly, count off 6 1/2 deg. to the right of the True Heading Index and read the True Heading (246 1/2 deg.).

Solve the problems in exercise 3 page 18.